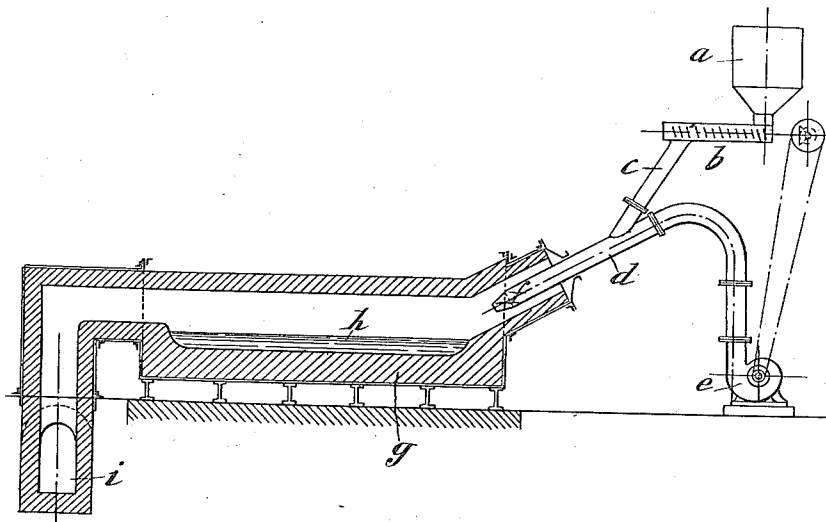


G. BARBANSON & M. LEPERSONNE.
 OPEN HEARTH PROCESS OF REFINING STEEL.
 APPLICATION FILED APR. 26, 1910.

1,030,152.

Patented June 18, 1912.



Witnesses:

S. Schiedbrand
 M. B. Taylor.

Inventors:

Gaston Barbanson and
Max Lepersonne
by Max Georgii
their attorney

UNITED STATES PATENT OFFICE.

GASTON BARBANSON AND MAX LEPERSONNE, OF BRUSSELS, BELGIUM.

OPEN-HEARTH PROCESS OF REFINING STEEL.

1,030,152.

Specification of Letters Patent.

Patented June 18, 1912.

Application filed April 26, 1910. Serial No. 557,754.

To all whom it may concern:

Be it known that we, GASTON BARBANSON and MAX LEPERSONNE, citizens of the Kingdom of Belgium, residing at Brussels, Belgium, have invented certain new and useful Improvements in the Open-Hearth Process of Refining Steel; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention has for its object to carry out the said process, namely the refining of steel in the open hearth furnace, by means of coal dust heating.

Heating with coal dust fuel has already been practised for metallurgical purposes; but heretofore the process has not been carried on in such a manner as to profit by all the advantages of this mode of heating. For example, with the idea of more satisfactorily attaining the high temperature necessary, the air required for the injection and combustion of the coal dust has been introduced in a highly heated condition, so that the coal dust was entirely or partially gasified a long time before ignition of the flame; the heating thus obtained was therefore gas heating, and the flames became so large that they could not be concentrated, as it is desirable that they should be on selected portions of the bath. When working with cold air, it was considered necessary to provide combustion chambers, with the result that the heat, being generated in a comparatively large space, could not be concentrated. For these reasons the necessity for obtaining heat in a concentrated form, for steel making, has not up to the present been met in any advantageous manner, except by the application of the electric current as the means of heating. It is, however, certain that the heat generated by electric energy is, even under the most economical conditions of production, more costly than the heat obtained by the combustion of coal.

The present invention aims at employing coal dust heating (by means of which an extraordinary degree of heat can be obtained) in such a manner as to enable nearly the same result to be obtained as by electric heating. To arrive at this result, care is taken to obtain as short a flame as possible, this being applied, in the most direct manner possible, to the bath to be heated. To this end, the nozzles through which the coal and

the air or the mixture of coal and air is injected are located at as short a distance from the bath as is feasible; this distance, which is a function of the mean length of the flame obtained, may advantageously be about forty inches. Moreover, in order to achieve the desired object, it is advantageous to blow in the air in merely a slightly heated condition, because in this way the premature gasification of the coal is prevented, thus precluding an undesirable increase in the volume of the flame.

The point at which the maximum temperature is developed may be adjusted at will by regulating the velocity of the injected air. It follows from this that the maximum temperature of the flame can be projected, at will, on to different portions of the bath. To obtain the highest possible temperature, it is advisable to arrange the mixture of coal dust and air in such a manner that neither of the two elements is in excess; nevertheless, an excess of air may, when the operation demands it, be provided, thus furnishing an oxidizing flame; or an excess of carbon can be given. In the latter contingency a deoxidation of the bath can be brought about, and, in some cases an addition of carbon to the bath may thus be supplied.

In the accompanying drawing I have shown an apparatus for carrying out my process by way of example.

a is a hopper containing the coal dust, which is conveyed by a worm *b*, into a pipe *c*, which is joined to the air pipe *d*. In this latter, the air supplied by a fan *e* mixes with the coal dust, the mixture entering the furnace by way of the nozzle *f*. Ignition occurs at a certain distance from the nozzle, and the flame impinges directly on the bath of metal *h* lying in the hearth *g* of the furnace. The products of combustion escape through the flue *i*.

It will be noted that the outlet for the products of combustion *i* is at a point opposite to the end of the hearth where the combustion nozzle *f* projects into the furnace. By this arrangement, the advantages obtained are, that the flame from the nozzle can impinge directly against the surface of the bath *h* and without being diverted or interfered with. The nozzle *f* is so arranged that the flame therefrom will directly impinge against the bath, whereby the heat of combustion is caused to act di-

rectly upon said bath at the proper point, and said bath is not, as heretofore, merely acted upon by the gases of combustion, due to said flame. For this purpose, the nozzle 5 *f* is arranged at a distance above the level of the bath *h* which is not greater than the distance from the point of ignition, and which is preferably somewhat less than said length. Thereby, and by virtue of 10 the fact that the air mixed with the powdered fuel is at a low temperature, the premature gasification of the fuel is prevented and the ignition takes place directly on the bath or material treated, the gener- 15 ated heat of which in turn serves to maintain the flame which generally spreads over the bath or material in thin sheet-like form. By arranging the inlet from the fuel duct feed pipe *c* into the air pipe *d* at a point *c'* 20 substantially to the rear of the tapering nozzle *f*, the fuel and air are uniformly commingled thereby forming a homogeneous mixture thus considerably aiding the ignition at the reaction point of the bath. By 25 such arrangement, we are enabled to utilize powdered fuel, such as coal dust, in such a way as to obtain substantially the same advantages that flow from the use of the electric arc, at a cost much lower than 30 when such electric arc is employed.

By the above process great uniformity and a homogeneous composition or proportion of the feed are attained; and those familiar with the art will readily under- 35 stand from their own experience the various points in the process at which to vary the character of the fuel and air feed, particularly in regard to its oxidizing, neutral, or reducing character. Moreover the short- 40 ness of the distance between the mixing of the fuel with the blast and the point of entry into the furnace is of great advantage, as, the shorter this distance is, the less chance will there be of the fuel be- 45 coming even partially gasified or of the fuel settling into a particular localized portion of the cross section of the blast.

Having thus described our invention, what we claim as new, and desire to secure 50 by Letters Patent is:

1. In the manufacture of steel, the process which consists in subjecting the materials

to be treated in a bath to the action of an open hearth furnace, causing the combustion of fuel dust in said furnace and causing 55 the flame of combustion to impinge directly against the surface of said bath.

2. In the process of manufacturing steel by the open hearth furnace the method of heating the bath consisting in forming a 60 short flame by directing an air blast onto the surface of the bath through a tube the nozzle of which is at a point adjacent to the surface of said bath and showering coal dust directly and continuously into said air 65 blast at a point immediately exterior to the furnace.

3. In the process of manufacturing steel by the open hearth furnace, the method of heating the bath consisting in mixing air 70 and fuel dust at a point immediately external to the furnace, causing the combustion of such mixture at a point immediately over the bath and directing the flame of combustion into direct impingement 75 against said bath.

4. In a method of obtaining steel in open hearth furnaces a process of treating the bath consisting in highly heating the same, mixing homogeneously a powdered com- 80 bustible with air at a temperature below that at which the combustible would become gasified, and then directing the said homogeneous mixture against the bath, the combustion of the mixture being effected 85 instantly and completely by the high temperature in the interior of the furnace.

5. In an open hearth process for the manufacture of steel, a method of treating the bath consisting in mixing air and fuel 90 dust prior to admission to the furnace, and feeding such air and fuel dust mixture to the furnace at a point from the surface of the bath not greater than the length of the flame of combustion and in a direction to 95 impinge on said surface.

In testimony whereof we affix our signatures to this specification, in the presence of two witnesses:

GASTON BARBANSON.
MAX LEPERSONNE.

Witnesses:

GREGORY PHELAN,
M. GERBAULT.